# INTER-TROCHANTERIC OSTEOTOMY WITH BENT KESSEL'S PLATE FIXATION IN FEMORAL NECK FRACTURES

THESIS
FOR
MASTER OF SURGERY
(ORTHOPAEDICS)





BUNDELKHAND UNIVERSITY JHANSI (U.P.)

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DEDICATED

TO THE MEMORY OF

MY MATERNAL UNCLE

(Late) DR. D.V.S. SIROMI

WHO WAS BOTH MY PRIEND AND GUIDE.

HE SUPPORTED HE AND MY TAKILY

IN OUR BAD DAYS

AND IT IS DECAUSE OF HIM

THAT I HAVE ATTAINED THIS PRESENT

POSITION IN MY LIFE.

DEPARTMENT OF GRINDPARDICS, M.L.B. MEDICAL COLLEGE, JHANSI (U.P.).

# CERTIFICATE

This is to cortify that the work entitled
"INTER-TROCHANTERIC OSTEODONY WITH BENT RESERL'S PLATS
FIXATION IN PEMORAL MECK PRACTURES", has been carried out
by DR. ARVIND SAHARAN himself in this department.

He has put in the necessary stay in the department as required by the rules and regulations of Dundelkhand University, Themsi.

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Dated: 29 Hov. 1990

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INTRODUCTION

#### INTRODUCTION

procture of femoral mack is usually a feature of old age, of either sex. It is usually sustained by trivial strains and despite such better knowledge of this fracture and marked improvement in the methods of its treatment, even today deserves the title of "unsolved fracture".

neet other fractures in human being heal readily or eventually without recourse to internal fixation, but femoral neck fractures, meet of which are unstable with displaced fragments and deficient muscle attachments, are indolent, as the union depends solely on medulary healing between the femoral head and nock.

Years ego, this fracture was often a terminal event in the life of feeble and fragile individuals who used to die within few weeks of injury due to cardiac, pulmonary or renal complications, aggrevated by the recumberry and immobility that was so often enforced.

Built for the control of the control

it has been long rangeled that interest (inchicate of the franchi of the fracture or procticate toplecoment of the franchi land within the first for days after injury to ritally important in order to parely early mobilization and them avoid the dangers of prolonged recumbency is elderly patients. Avascular secretis can jeopardise the results even in the most rigid internal fixation, whereas prosthetic replacement of head gives after all only a cartilage to metal articulation, and often results in a painful hip.

It is seen that the replacement operations give stability to the hip, but the ultimate painful restriction of terminal degree of movements at hip may not allow most of the patients to perform basic functions like defectation, esting, household work or worshipping in the traditional Indian style. These functions require extreme degree of painless movements of flexion, adduction and external sotation at hip. The seplacement asthroplasty can give a meer normal life to the elderly patients of western countries but not in our country where most of the patients come from poor socio-economic status with entirely different way of living. In our society, the achievement of fracture meck femur treatment are ideal only when a patient can mit in the posture of worship, a housewife can perform household work with hip and knee flexed and one can sit in Indian style of toilet and bathfoom in squatting positions.

Excision arthroplasty can ensuer the problem for our society but this too is essociated with unstable hip and shortening. Inter-trochemteric estectomy has given uniformly promising results. In elderly patients, estectomy may be internally fixed to allow early mobilization. Various estectomy plates have been used for this purpose from time to time. Straight plates (like waim wright, Kessel etc.) do not allow angulation and Bloumt's Blade-plate, spart from other technical difficulties does not allow displacement. With this idea, Chatterjee (1979) modified his pre-existing straight plate by bending it (30°) and found marked improvement in results. Then Prof. Hohindra, Y. (1986) used bent Kessel's plate (30°) and put forward encouraging results.

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REVIEW OF LITERATURE

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#### REVIEW OF LITERATURE

To know, how intracapaular fracture behaves, it is useful to have knowledge about Amatomy of blood supply to head and neck of femur.

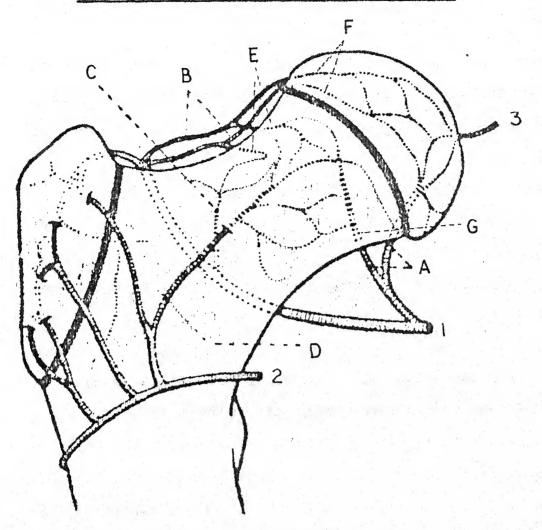
# Morreal Vascular Apatomy of the Femoral Head and Heck :

The Semoral head and mack receive their blood supply from the retinecular (capsular) arteries lying on the mack separally the superior group (Moloday, 1925; Moleott, 1943; Tucker, 1949; Harty, 1953) and within the head, the lateral epiphyseal (superior capital) branches of the superior retinecular supply are of particular importance (Trusta & Harsison, 1953; Judet et al., 1985).

The retineraler enteries are derived from the eigenflow femoral vectors especially the medial one, and they pass to the head under synovium on the neck. The main vectors are superior and inferior groups with smaller and less constant unterior and posterior arteries, which together with small inter-communications from the circulum articuli vectors of Millian Sunter (1743).

the popular believes around an four to the same of the

#### BLOOD SUPPLY OF HEAD AND NECK OF FEMUR.



- I MEDIAL FEMORAL CIRCUMFLEX A.
- 2-LATERAL FEMORAL CIRCUMFLEX A.
- 3- ARTERY OF THE LIGAMENT OF THE HEAD.
- A-POSTERO-INFERIOR RETINACULAR ARTERIES TO THE FEMORAL HEAD AND NECK.
- B-POSTERO-SUPERIOR RETINACULAR ARTERIES TO THE FEMORAL HEAD AND NECK.
- C-POSTERIOR A. TO THE NECK.
- D-ANTERIOR BRANCH TO THE NECK.
- E-CERVICAL BRANCHES OF POSTERO-SUPERIOR RETINACULAR ARTERIES.
- F-LATERAL EPIPHYSEAL ARTERIES.
- G-INFERIOR METAPHYSEAL BRANCHES.

metaphyseal branches which, immediately panetrate the certex and pass into the neck and the metaphyseal region of the head respectively. The superior retinacular arteries penetrate the cortex at the medial end of the neck, and continue within the head as lateral epiphyseal arteries. They pass along the line of the old epiphyseal plate in a gentle curve to the foves and below and they give off many multi-arcaded epiphyseal branches directed towards the articular cartilage. Obviously much or most of the head and always its medial and superior parts are supplied by lateral epiphyseal branches. The source of the supply to the lateral half of the head varies, which may be supplied by branches of lateral epiphyseal vessels, or from superior metaphyseal tributaries or from a mixature of these sources.

Inforior retinacular arteries are fewer and smaller than the superior once. They give off small cervical branches, passtrate the sortex near the head and terminate as inferior metaphyseal branches in the inferior and lateral part of the head. The enterior and posterior retinacular arteries pass through the cortex and break into local networks.

The passels of the Ligensatus tores are derived from a branch of the obtaining attary. In adults, many of the resouls are often colonoods. When they exter the force

they ramify locally and seem to join distal tributaries of the lateral epiphyseal arteries.

The neck of the femur receives important superior cervical vessels from the superior retinacular supply.

After penetrating the cervical cortex, they pursue a straight course obliquely downwards and laterally to ramify with vessels from the trochenter and with cervical branches of the inferior and other retinacular vessels.

#### Avasquier Mecrosia after intra-capsular fractures :

It is very common, rapid in emeet, unrelated to infection, evencular in origin and allied to infection. It is due to the tenning of synovial retinecular folds on the femoral mack and interruption of their vescels. Histologically, it is characterized by a cellularity of the affected bone and marrow, though estencytes take time to disappear, making difficult histological diagnosis within a week or two of injury.

those involving the subsequial to the busine parts of the seck, but it has been descentioned that normal capital vaccularity in the fenors of subjects with extracapoular fractures femalus. This confirms the importance of the intercepoular location of the fractures for avaccular confirms.

Clinically avascular necrosis of the femeral head is guided by change in its density which is of late onset, commonly 1 to 3 years after fracture. Lete enset of increased radio-opacity does not imply a slow or delayed onset of necrosis, merely its inevitably late recognition by radiological means due to subsequent changes.

# Contribution of the Feil to Capital Regresse and Revesquiarisation :

of nailing but the possibility has been raised that fixation by a nail is associated with an increased frequency of necrosis (Linton, 1944). Angiographic analysis of 44 experimental cases showed that gross necrosis had occurred in 82% of 34 nailed specimens as compared to 70% of 10 not internally fixed, but the distribution of the avascularity in specimens suggested that the nail was implicated. The nail can also hinder or modify revencularisation of head.

# Union and non-union of Practure :

The bridging of introcepoular frectures depend entirely on medullary repair (Denks, 1964; Seviet, 1964; Cotto, 1976). Periodecal callue is never produced since the periodecus of the Semeral mesh consists only of consective times and door not persons a contine layer; a feature originally betok by Johnson (1924). Medullary

dependence largely explains the difficulties for union of displaced fractures especially the subcapital variety. Surgeons know that to echieve perfect union, the fragments need accurate reduction and firm apposition of stable internal fixation. Only then the tissue from the medulia can readily bridge the fracture. Unstable fixation can leave its histological mark at the fracture site.

Hon-unions generally occur in 15% to 30% of displaced subsepital fractures treated by mails, screws, mail plates or multiple pins used now-e-days due to ineccurate reduction, unstable fixation, fragmentation of head, comminution of mack and progenic infection along the mail track (Fielding et al. 1962; Banks, 1962; 1964; Burnes et al., 1976 and others).

that the planed mecha united when the head and mock were kept in their correct relationship, but they did not when the head was sufficiently rotated, regardless of the fixation. He also believed that failure of union is resultant from mechanical etresses on the head due to its improper position in the acotabulum.

books to toward the freetance was, man followed by actoryould be fiberationally granulation there. In the course become more and more vascular, much more than usual even before bridging takes place. Hypervascularity persists after bridging or even increases.

the metaphysis anastomose with those growing from the meck and though the vascularity remains excessive for months efter union, it eventually returns to normal. Similarly vessels aprouting in the head and nack meet and merge at the bridging line when revascularisation of a merotic part of the head reaches the fracture.

Osteogenesis in the healing meck soom follows.

Within a few days small foci of new immature bone are

formed in the medulia and they progressively increase

during the next weeks, together with the variable amount

of fibrous tissue. These are the bases of future osseous

union, fibrous bridging and the fibrous path to bony union.

when the fracture fails to bridge, the fibrous tissue proliferating within the neck migrates over the end of the fracture and comes to form an adherent fibrous sheet over its surface. These fibrous sheets were common in fractures treated without internal fixation and in un-united fractures.

# Role of Aveggular Begrosis in Union :

Capital mecrosis is a potent cause of non-union and paeudesthrosis after internal fixation. Phemister (1934)

suggested that a viable head is important for union.

However, union of fractures with capital merosis has been reported by many workers (Axhansen, 1932; Benn, 1925; santor, 1930; Phemister, 1930; 1934; Sharma and Phemister, 1947; Charmley et al, 1957; Nicol, 1963; Banks, 1964; Sevitt, 1964; Catto, 1965a).

#### Internal Fixation of Fracture :

Smith Peterson (1931) is credited with reviving and popularizing the procedure of internal fixation for femoral neck fractures.

For displaced fracture of femoral mack, surgeons now agree that reduction, impaction and rigid internal fixation are required if union is to be predictable.

Presently, Smith Peterson nails are less frequently used since superior fixation can be obtained by several of the never devices now available.

#### METHODS OF INTERNAL FIXATION

# Swith Peterson Pin (1931) :

Success rate 30 percent (1932 and 1937). Johnson medified the technique and changed the success rate to 50%.

# Yazietions of S.P. Heiling :

. Jary (1964) introduced transarticular nailing where a large nail is pushed into the ilium through the joint

space. This causes severe stiffness later and is not recommended. Britain (1942) first used and later Garden (1961) popularized a large, low angle nail or serew resting on the calcar femorale and placed in a more vertical disposition. But it is more prope to slide out end there may be a fracture at the level of introduction of the nail.

- . Fin and Flates. Several types of pins and plates are available which can be combined with an osteotomy.
- . Jewett (1956) introduced fixed angle plate.
- . Charnley (1957) sliding pin-plate with or without spring leading.
- . Compression hip screw with mail-plate.
- . Fibular bome graft with or without pin (Markrief et al. 1973).
- . Saha (1978) reseive tibial cortical graft taken from the skin with an i shaped cross section. Fixation is not rigid enough.
- . Multiple pins and screws of Knowle's or Mooro's type.
- Pedicle bone graft using a portion of greater trochanter with quadratus femoria as the muscle pedicle (Judit, 1962 and Reyers et al. 1973).

- . Lateral plate with multiple threaded pins of Deyerle
  (1965, 1966). Deyerle claims 13 times more rigid fixetion
  than 5.P. nail. The operation is complicated and requires
  first class X-ray facility in the operation theatre.
- . Garden's gross screw technique (1964).
- . Smyth's triangular pinning (1964, 1974).

The last two techniques have proved highly successful in the hands of their authors but are complicated and require localising device and image intensifier facility in the operation theatre. Results of various types of internal fixation have been shown in Table I (Chatterjee, 1979).

TABLE 1

Dome Published Results of Internal Paxation.

Procedure			Results (Per cent)			
	Author	Year	No.of	MOT- 707700	TOBLE	fetal
S.F.Nail	St. Lukas	1952	63	22.0	25.0	47.0
	Boyd & Salvator	1964	400	11.2	36.8	48.0
	Boyd & George	1947	360	13.5	33.6	47.0
Low Angle	Garden	1961	60	25.0	16.0	41.0
Cross Serews	Carden	1971	406	25.0	21.3	46.3
Trienguler Tixation	Smyth & Sheh	1974	70	18.0	40.0	58.0
Deyerle Plate b Pine	Nets et al	1970	63	4.7	11.6	16.3
DRRC Report on verious methods of internal fixation	Barnes et al	1976	1503	38.0	20.0	40.0

#### Primary Prosthetic Replacement of Femoral Head :

Because non-union and avascular necrosis develop frequently after internal fixation, some surgeons have recommended primary prosthetic replacement of head of femur as an alternative treatment. Cornesalli and Anderson studied the long term results of 100 primary prosthetic replacement and found only 60% good results with complication rate 30% that included 5% mortality rate. Hunter (1969) reported satisfactory results of prosthetic replacement in a series of 94 patients after an average follow-up of 16 months.

In 1973 Selvati and Wilson reported their results on 436 replacements for various hip disorders after an average follow-up of 9.6 months and showed excellent to good results in 70% of the cases of fresh fractures and non-union of femoral neck.

in 1975 Jonson and Holstein presented the followup results of 60 Moore proathesis and reported excellent
to good results in 52% and fair in 43% cases. Bengt
Tillbarg (1976) presented the results of 163 patients of
feworal meak fractures treated by prosthesis, after a
follow-up of 3.4 years (average) and showed that 95% were
good functionally, 77% were without pain and 93% could
manage their routine activities.

Even that prosthetic replacement is not without complications as :

- 1. Mortality about 13.4% (Class, 1965).
- 2. Infection rate 10%.
- 3. Fracture of feworal shaft during or after insertion.
- 4. Dislocation of the prosthesis.
- 5. Leasening of the prosthesis causing pain.
- 6. Distal migration.
- 7. Heterotopic ossification.
- 8. Metal fatigue and fracture of the preathesis.
- 9. Protrussio acetabuli.

#### OSTEUTOMY OF THE UPPER FEMUR

#### Mistorical Background :

It was in 1826 that John Rhea Barton of Philadelphia performed an extentomy between the greater and lesser trochanter in a sailor with an anhylesed hip joint in adduction, internal rotation and flexion due to an old fracture with infection. This is the first record of a surgical operation on a hip performed in United States. In 1882, Anthony white of London, performed a similar sub-trochanteric estectomy. Barton's estectomy resulted in a pseudarthrosis.

Following this, many different estectomies were performed. Nouvier in Peris (1835), Lengamback in Germany (1854), Brodhurst (1865) and Adams (1869) in England.

In 1863 Lewis A. Sayre of New York performed an osteotomy for ankylosis of hip by removing a block of home. He called his procedure, a modification of Harton's osteotomy.

in 1879, Gent performed an abduction subtrochanteric osteotomy, which still bears his name and
became extremely popular. In 1919 Lorenz reported an
unusual bifurcation operation which was a modification
of the Kirmission operation of 1894. This was done mainly
to secure stability in cases of old unreduced congenital
dislocation and old hip fracture.

schanz (1922) in Dresden reported using a low sub-trochanteric abduction asteotomy to secure better stabilisation in an old hip fracture and for unreduced congenital dislocations. This technique also became extremely popular. One of Schanz's pupil, Fauwell (1935) described an abduction osteotomy at the inter-trochenteric level. In 1936 Mc Murray reported the technique of displacement osteotomy for osteoarthresis of the hip and non-united fractures of the mack of femur. In 1938, Mc Murray again described his osteotomy in fresh femoral neck fractures.

In 1941, Henry Milch, described a "Felvic support"
Abduction Catestony. In 1944, Leadhetter described an
axial displacement setsetony for osteoarthrosis of hip and
an-united fractures of the neck of femur. Blount (1943)

advised internal fixation of the fracture and osteotomy for established non-union of the femoral neck fractures.

Dickson (1947) suggested a high geometric osteotomy and bone graft for femoral neck fractures. In 1950.

Deralma recommended a wedge osteotomy and in 1953 Me Nour recommended a wedge osteotomy with fixation by sail-plate.

#### Primary Ostootomy for Femoral Neck Fracture :

Among other techniques developed for treatment of femoral neck fracture Mc Murray's inter-trochanteric displacement osteotomy was, in early stage, used for old un-united fractures as a salvage procedure; however, later many surgeons including Mc Murray (1938) used it as primary treatment for fresh fractures.

Stor (1936), Me Murray (1936), Dawkins (1941) and Blount (1943) have proposed primary estectomy as a big improvement on simple nailing, reason being :

- Sub-trochenteric estectory leads to bone union of old and un-united fractures. So if used in recent fractures, it should increase the number of bone unions.
- 2. If the osteotomy fails to cause fracture union, "it leaves a hip joint that is perfectly stable, on which the patient can walk without discomfort and without pain (Mc Murray, 1938).

3. It usually cures or relieves the pain and disability caused by degenerative changes in the hip joint (traumatic OA) which follow upon avascular necrosis of the femoral head.

King (1950) showed the advantages of primary osteotomy as under :

- (a) The mechanical advantages of osteotomy are that the line of weight bearing is shifted medially and that the shearing force at the fracture site is converted into a compression force, which promotes union.
- (b) It is responsible for the relief of pain of osteoarthrosis (caused by avascular necrosis), should it develop.
- (c) Amoptic necrosis is less frequent (4%) after primary estectomy than after nailing (28%).

"The beauty of the whole procedure however, is that, should union not occur, the patient is still assured of a satisfactory hip" (Dawkin, 1940). "The osteotomy still succeeds because it provides an excellent arthroplasty even after non-union and avascular necrosis" (Watson Jones, 1943). Futti (1942) stated that there was "decided improvement in function".

## Indications of Primary Osteobomy :

King (1950) outlined the special diremstances in which primary estectory is indicated.

- If the fracture is more than four weeks ald and meck shows early absorption,
- if lateral view in x-ray on osteotomy table shows that fracture has not been accurately reduced.
- 3. If the mock is comminuted, especially if the splintering of the mock extends into the trochenteric region.
- 4. If there is a large posterior defect in the neck.
- S. If the bone is decalcified and soft.
- 6. If the patient is heavy manual labourer under fifty, where generalised or localised degenerative changes in the head of fewer might projudice his livelihood.
- 7. If osten-erthritis of the hip is present in patients who have sustained a recent fracture.
- 8. If the vertical type of fracture is present.

# Sub-trochenteric Osteotowy as the Primary Treatment of the Femoral Nock Fracture :

achana (1928) gave the statement about mechanics underlying the treatment of femoral neck fracture. "Through the angulation of the neck, the fracture site is placed

below the head and the body weight no longer pushes the head downward past the fracture surface but directly against it. This provides more favourable weight bearing relations and may even lead to late bony union".

Schumm (1937) described the indications for this operation as (1) disability due to instability of the hip, which may be accompanied by Varying degree of pain and fatigue; (2) those cases of delayed union or non-union with costs vars deformity in which there is still a chance to effect a union by relieving the shearing force present.

leaser trochester as possible is spoken as high estectomy and done for cases in which an insidiously developing come vara indicates a prospective non-union. Whereas in cases of definite non-union with absorption of the neck, in which there is a marked upward riding of the shaft so that the fracture surface have slid by another, osteotomy is done several centimeters lower and called low osteotomy. Shans (1928) pointed out that in low osteotomy, angle varies between 35 - 60 degrees. In the high osteotomy, the angle should be somewhat greater, varying between 45 and 70 degrees.

Sub-trochanteric osteotomy results indefinite increase in stability of the hip, without seriously interfering the hip motion due to (1) improved leverage conditions favouring the gluteli, (2) improved efficiency

of the gluteii themselves when they are taught, and
(3) contact of the angulated upper fragment against the
pelvic wall.

Ratliff (1962) considered the primary osteotomy in cases e.g. (1) displaced femoral mack fractures in children under 10 years of age, (2) in older children where a good reduction of fracture cannot be achieved.

Best results of osteotomy were obtained when the displacement was slight and internal fixation not employed (Ratliff, 1962).

it was also clear that displacement of osteotomy may play a part as a secondary salvage operation in the presence of complications such as delayed union and non-union (Ratliff, 1962).

#### Internal Pixation of Cateotomy :

Catestomy of the femur just above or below the lesser trochanter has been accepted as an important procedure in the treatment of femoral neck fractures. The difficulty of maintaining the desired position after osteotomy has been emphasized by Bracket (1912) and Unger and waring (1940). A plaster spica may hold the fragments in some cases, but good position cannot be regularly assured without some additional fixation device.

For fixation of osteotomy, Schanz (1928) advocated the use of crossed acress held in position by wire. Riedel (1930) simplified and improved this technique by adding a

plate across the ends of the screws. Plaster fixation for a period of about eight weeks was still necessary. In young individual, this was of little consequence. But in old patients, particularly those with stiffness of the knee from previous cast fixation, it was a great disadvantage.

For several years, Blount had tried various methods of internal fixation for eliminating the cast, but none was entirely satisfactory.

In 1941. Moore demonstrated a device for the internal splinting of trochanteric fractures which Blownt recognised as the long sought principle of fixing outcomes.

Because of the abrupt variation in the structure of the bone at this level, it was necessary to use a device which combined a blade above, with a plate below the site of osteotomy. By inserting a second angle, three quarter of an inch below the first, a double angle blade-plate was evolved, which securely held an angulated femoral nateotomy. Any degree of angulation or rotation was accurately maintained. Undesirable angulation and rotation was prevented. The blade-plate has since been simplified and adopted for a variety of purposes.

Plount(1943) advocated a double angled bladeplate for the fixation of fracture as well as estectomy.

The procedure is not recommended unless there is a viable head without degenerative change and a good reduction of fracture. The use of too long a blade has resulted in its gradual protrusion through the head into the scetabulum. It is essential to make a tracing of the rountgenogram before performing an angulation osteotomy. Angulation of the femur should be accurately peasured with a protractor. 40° is the average angle in cases of un-united fractures. For the high astectomy, the angle between the goose neck and plate will be about 100°, whereas in a low osteotomy the angle should be more obtuse. In driving the singleangle or a double angle blade-plate with an acute proximal angle, a driver is necessary whereas a nearly straight blade-plate may be driven home by direct hammering. By the use of blade-plate in the Mc Murray operation, some angulation may be obtained and the displacement of the fragments may be accurately controlled without a cast.

miount (1943) further emphasised that the best, and results can be obtained by an estectory at the level of the lesser trochanter with angulation of the proximal frequent and some medial displacement of the distal fragment. In the high estectory, knock knee is not troublesome (Blount, 1943).

The fixation secured by a blade-plate is effective in securing repid body union and most patients may walk without crutches before eight weeks. Although early weight

bearing is contre-indicated in fresh femoral neck fractures, it is desirable in most lesions for which a high osteotomy is performed. The method is particularly applicable in adults where a cast would be a hardship.

#### Union of Osteotomy Site :

Many surgeons are of the opinion that all osteotomies be fixed internally as originally suggested by Blount (1943).

The appliances for internal fixation used most frequently are the angulated blade-plates like those of Blount; V-nail plate etc. and straight blade-plate like those of Kessel, waim Wright, Harris-Muller, Chatterjee plate etc.

to Rosborough and Stiles (1967), Scott and Green (1967), displacing the distal fragment too much medially may cause non-union. The incidence increased sharply when displacement approached or exceeded 60% of the dismeter of the sheft. Pixing the estectomy in too much of a varue position is also considered a cause. King (1950) showed that there was no incidence of non-union at estectomy site in the first 75 recent fractures. The reason for this was almost certainly the internal fination after impacting the femoral sheft into the base of the trochanteric bone (King, 1950).

#### Displacement Ostootomy :

transcervical femoral neck fractures with satisfactory results. Firm bony union occurred in each case at fracture as well as osteotomy site. The patients were all able to stand and welk without a limb and with a hip joint, perfectly stable in every direction. In no case was there any trace of absorption or disintegration of the head of the femur — in fact the application of pressure from the trochanteric fragment against the head of the femur had prevented even temporary 'decalcification' so domnonly seem. The real disadvantages that he could find were, shortening of about 0.5 to 0.75 inches and less of power of adduction of the thigh aeroes the middle line of body.

He also emphasized that the inward displacement of the distal fragment must be complete, so that the upper end of the lower fragment lies directly under the femoral head, failing which the esteetomy will simply result in a pushing upward of the trochanteric fragment. He further suggested that abduction of limb should not be more than 20°, failing which, rotation inwards of the upper fragments under the head of femur so essential for union of fracture, is not possible.

Inward rotation of lower border of truchanter, after medial displacement of shaft, rotates the femoral

head hence converting the previous vertical fracture line
into transverse one. So long as this position is maintained,
muscular pull simply produces greater pressure between the
fracture surfaces. This apposition cannot be altered
because the shaft of femur, lying in its new position
acts as rigid street.

both old and recent fractures and used hip spice for 6
weeks, union of the fractures occurred in 36%, but the climical
results were satisfactory in 96% cases, 80% had full
movements of the knee. No mortality was there. Good
results after Ne Murray's osteotomy were also corroborated
by Dholakia, Talwalkar, Mullick, Fillay, Sen, Katrak,
Bhattacharya and Shansali in a symposium on Me Murray's
osteotomy held in Bombay in 1964.

Results of Mc Murray's Osteotomy are very encouraging as shown in Table II.

TABLE II

		No.of		Recul	te	
Authors	Year	04864	Exce- llent	Good	Felf	Poor
de Nurray	1938	33	*	33	•	•
Reich	1941	26	•	22	***	4
King	1950	50	•	50	•	***
Petrie	1950	25		25	•	
haturvedi and Gupta	1969	55	9	33	10	3
Supta and Cheturvedi	1973	38	11	10	•	
tellan and irivestave	1976	50		19	15	7
Lishra	1979	51	•	66.	6×	33.3
icel et al	19-80	66	16	32	1.0	

TABLE III

Radiological status of Pollow-up in various series after
No Murray's Osteotomy.

Author	Year	No.of CAMES	Union at Datectomy (%)	Union at Fracture (x)	Avesculer mecrosis of head of femus (%)
Me Murray (According to Futti)	1947	23	100	100	•
Kirkup	1963	41	100	61	23
Chaturvedi and Cupta	1969	55	190	30.9	16.4
Supta and Chatur <b>ved</b> i	1973	38	100	60.0	19.42
Rallan and Srivestava	1976	50	90	42.0	
ilahra	1979	51	100	73.6	
Soel et al	1980	66	100	60.6	18.2

### Methods of Immobilization of Osteotomy :

Plaster hip spice is considered as a better method of immobilisation of ostsotomy by Chaturvedi and Gupta (1969). Mishra (1979), Gool et al (1980) and Mehrotra et al (1982).

Percentage of fracture union are higher in cases where immobilization was done by POP hip spice (71.4% cases of Gool et al. 1960; 70% Mehrotra et al. 1982) as compared to where internal fixation of the estectony has been done by straight plate (52.6% of Gool et al. 1960; 23% Mehrotra et al. 1982).

The discrepancy was explained on the basis that wain wright plate provided fixation to osteotomy alone while por hip spice immobilised both osteotomy as well as fracture (Mehrotra et al. 1982).

chaturved; and Cupta (1969) did osteotewy and fixed it with Main Wright plate in 5 cases (9.06%) where fracture failed to unite, because plate did not allow adduction of trochemteric fragment, which is essential for union of fracture (Me Murray, 1936; Wardle, 1955). However, good results were found after fixation of osteotemy by Massel plate and straight Chatterjee compression plate (Rallam and Grivastava, 1976). More percentage of patients could squat and sit cross-legged after ismobilization with Wain Wright plate (Goel et al. 1980). Seep wound infection was a problem after internal fixation (31.5%) (Goel et al. 1980).

Shortening of the limb was a drawback of the operation as agreed by almost all the workers (Table IV) -

TABLE IV

Author	Year	Real shortening
Ke Murray	1938	0.5 to 0.75 inches
Chaturvedi and Gupta	1969	3 em (average)
Rallen and Sgivestave	1976	0.5 to 2.0 inches
Mishra	1979	0.5 to 1.0 inch (95%)
Sool et al	1980	1 inch (69.7%) (everage)
Mehrotra et al	19 82	2.5 cm (74.4%) (average)

More the time elapsed before operation, more was the shortening (Mallan and Srivestave, 1976; Michra, 1979; Goul et al, 1980).

Chaturedi and Supta (1969) believed that abduction of distal shaft after displacement osteotomy helped to restore the length of the limb only without any other functional advantage.

Mishra (1979) recommended high catestomy with adequate medial displacement, as low estectomy by allowing upward migration of the distal fragment and greater trochester adds to shortening.

### Modifications of Mc Murray Ostootomy\*

Two modifications have been devised to obtain the adventages of displacement as well as angulation both :

- i. When the neck is well preserved and the fragments can be reduced, the non-union is fixed with two knowle's pins and estectomy is fixed with a reversed Blount or Neufold mail, bent to a reversed angle of 150°.
- 2. When the meck is short, the knowle's pins are omitted but the osteotomy is fixed by Neufold neil, which allows impaction that in turn assures contact between the shaft and trochanteric fragments. The osteotomy should not be too oblique nor too high to include the base of the meck, in the latter instance, a medial projection of bone would

<sup>\*</sup> Compbell Operative Orthopoedic, Vol. 2, Ed. 5, P. 693.

prevent displacing the shaft beneath the head. At the end of the operation, the shaft should be well displaced beneath the head and the trochanter should be at the angle of not less than 150° to the shaft.

with abduction of lower fragment, producing a high fractureshaft angle. No significant improvement was found in the
frequency of bone union of femoral neck fractures treated by
primary osteodomy. Avascular necrosis was found to be 28%
after nailing and 42% after nailing + bone grafting, but was
rare (4%) after primary osteodomy (King, 1950). In the 50
patients reported, primary osteodomy did not introduce any
important complications as compared with simple nailing
(Table V).

Poppworth (1963) said that mailing subcapital fracture of the femoral mack gave success in only 25% of cases. Therefore, he had combined, reduction of the fracture with displacement esteetony and fixation with mail plate. The mail was introduced through the cut end of the bone provided the shaft was displaced adequately to support the femoral head.

Wirkup (1963) reported 84 patients treated similarly with a follow-up of 6 months to 6 years. All the osteotomies united but 39% had non-union of the fracture and 32% had avascular meroeis. Patients walked on avascular heads without pais. The procedure was indicated particularly for the vertical type of fractures.

TABLE Y

(2) 016 (over 6 weeks) un-united fracture of the femoral mech treated by Catactomy with (m) mailing \* Fibular Graft, (C) Primary Osteotomy with Nail and Plate Fixation, and Comparison of results in recent intra-capsular fractures with (A) simple Hailing, Bail and Plate Pixation (xing, 1950).

		Recent Fractures	Recent Yra	Becent Fractures	Becch	Recent Fractures	30	old Fractures
		Simple mailing (300 patients)	Combine and but (31 pr	Combined nail and bone graft (31 patients)	osteotomy, nail and p (50 patien	osteotomy, nail and plate (50 patients)	Coste Coste Plate	(6 weeks to 12 months duration) Osteotomy, Bail & plate(26 patients)
Presture Union	\$	(K69) 69	22	22 (71%)	*	36 (72%)	2	19 (79.2%)
Hon-union of Precture	2	22 (17%)	•	WE-6)	•	200	•	WC-91)
1	*	24 (16.5)	•	(19.3%)	in	2 3	-	72.5
Found Indeed.		3 .	•	WE-63	•	20	The second secon	sane
Apparates mecrosis of femoral head	2	28 (28%)	2	(4230	•	7 3	244	Operation not done if head of femur deformed.
					2	**************************************		Hone

Increasing the Frecture-shaft angle to Fremote Frecture

primary estectomy at the time of nailing in order to increase the fracture-shaft angle has been recommended by King (1939, 1950), Eyro-Brook and Pride (1941) and Per-Linton (1944). Pauvell (1935) recommended that after waiting for absorption of the femoral mack to take place, an osteotomy of the wedge type should be performed.

For established non-union, Dickson (1947) suggested a controlled estectomy producing abduction of 60°. He devised an operation that combines the angulation estectomy with an estecsynthesis. This estectomy changes the angle of weight bearing by exactly 45°. When non-union is recognised early before sclerosis and absorption, the estectomy is used alone, otherwise it is combined with bone graft to hasten union.

peralma (1950) showed 10% non-union of femeral neck fractures after open reduction and wedge estectory through the distal fragment of neck, so that the head could be placed in a position of valgus. Thus providing the compression force by ilio-femeral numcles, necessary for the union of fracture, which are effective even in the presence of partial or total vascular occlusion of expital fragment. The lower incidence of avascular necrosis (18%) in Depalma's series may be due to the repid healing process that takes place at the fracture site when the femoral head is placed and fixed in a position of valcus.

McKeur (1953) after doing wedge osteotomy and nail plate fixation of fracture and osteotomy showed union of fracture as well as osteotomy in 80% cases with good functional results and no measurable alteration in the langth of the limb. The fracture shaft angle was increased to 55° or more. He considered that abduction of exactly 60° (of Dickson, 1947) was not mecessary for every case but the degree of abduction should vary with the measurement of fracture shaft angle and to obtain abduction of the head and stability, a wedge osteotomy with the base laterally should be ideal (Table VI).

TABLE VI have of wedge to be removed for varying bone dismeters and produce a given angle of abduction.

Diameter		ang le e	_ebducti	on require	14
of bone in inches	20°	30°	40*	50°	600
1.0	0.35	0.53	0.72	0.93	1.15
1.2	0.42	0.64	0.86	1.02	1.38
1.4	0.49	0.75	1.01	1.30	1.51
2.6	0.56	0.05	1.15	1.49	1.05
1.0	0.63	0.96	1.29	1.68	2.00
2.0	0.70	1.07	1.44	1.86	2.31
		nee of s	edges in	inches	

Note: Abduction of 30°, 40°, 50° wedge has a base equal to helf, three-fourth or just less than the full diameter of the bone respectively.

of displaced femeral meck fractures in which he used a technique of wedge-displacement estectomy fixed with bent (30°) Chatterjee plate with gratifying results.

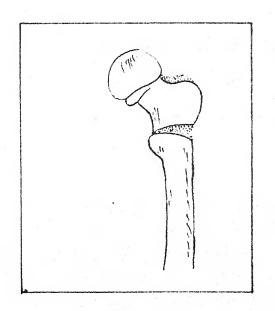
Cateotomy was done and a thin wedge (0.25 inch base laterally) of bone from below the greater trachanter has been removed and adequate medial displacement was achieved. Internal fixation of cateotomy was performed by a special plate (known after his name) bent 30° introduced from the tip of greater trachanter and fixed with screws to shaft.

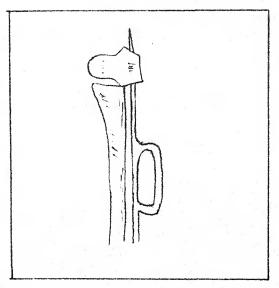
He showed several added advantages as :

- 1. Introduction was much easier than the straight plate.
- "Rigid varue positioning" caused by straight plate was avoided, on the contrary there was a Valgue position.
- 3. Shortening was diminished due to abduction.

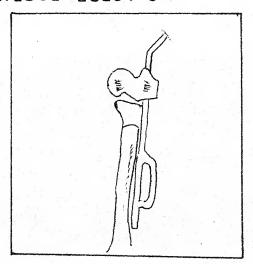
Although a slight limp was expected in most cases and an excellent result was rare, yet a good or fair result was found in over 80% of the cases. The problems of non-union, avascular necrosis with late segmental collapse, shortening and comevers were minimal.

### CHATTERJEE'S TECHNIQUE OF OSTEOTOMY AND PLATING

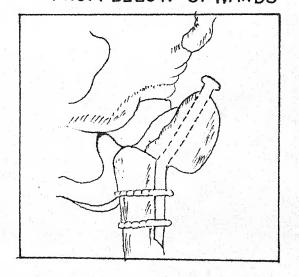




REPRESENTATION OF WEDGE RESECTION



GUIDE SWORD INTRODUCED FROM BELOW UPWARDS



A BENT CHATTERJEE PLATE BEING INTRODUCED FROM ABOVE DOWN WARDS BY RAIL-ROAD METHOD.

WEDGE-DISPLACEMENT OSTEOTOMY USING A BENT CHATTERJEE PLATE.

TABLE VII

Fublished results (Chatterjee, 1979).

(Follow-up period - 12 months)

MO.	Parameter	No.of cases
1.	Total number of cases	100
2.	Operative mortality	NAL
3.	Post-operative mortality (within 3 months)	
4.	Infection	
5.	Kon-union of osteotomy	H&1
6.	Mon-union of fracture	21
7.	Avecular necrosis	15

Chatterjee recommended his procedure for routine use as it is simple and can be done by any surgeon on ordinary operation table. X-ray facility in the operation theatre was not required. Everything was done under vision.

### TABLE VILL

# Evaluation of Results after MG Murray Ostaotomy

Chaturvedi and Cupta (1969) evaluated the results as follows :

	CLINICAL ASSESSMENT	180000000000000000000000000000000000000	RADIOLOGICAL ASSESSMENT
Weelless (16.36%)	No pain or disability. Can welk any distance, not handleapped in normal life.	Roserents at hip almost full, shorten-ing minimal or megli-gible, stable hip.	Eite of osteotomy and fracture united. Femoral hand normal.
	No or occasional pain in hip. No merked disability, cen valk to a ressonable distance, occasionally feels handicapped.	Terrinal degree of restriction at hip movements at hip, shortening compensated with raised heels, stable hip.	Site of osteotomy united. Union of fracture site is doubtful, femoral head normal.
704E 10 0000 (10.1000	Constant but bearable pain, welking but not normal, falt handleapped.	Reasonable loss of joint motions. Stability doubtful.	Lite of osteotomy united. Fracture may or may not be united. Viability of head is doubtful.
į	Asything beyond above.	Unstable hip and above.	Situation beyond above.

Chatterjee (1979) evaluated the functional Fesults as :

Excellent: 2 cases 1. Shortening less than 0.5"

2. No limping,

J. No pain,

4. Full range of movements.

Good : 59 cases 1. Shortening less than 1"

2. Slight limping.

J. No pain,

4. Nearly full movements.

Fair : 23 cases 1. Shortening less than 1.5"

2. Moderate to severe limping.

3. Slight pain,

4. Range of movements of 90° or more.

Poor : 10 cases 1. Shortening 2" (rarely more)

2. Gross limping.

J. Persistant pain,

4. Range of movements of less than 90°.

\*ishra (1979) evaluated the results by analysing the following fectors : Pain, mobility in the hip.

Shortening, limp and patient's own assessment of the spendition.

TABLE IX

Clinical condition Radiological Fracture and ostectomy Good No pain in the hip. both united. No limp No evidence of avascular Mormal or near normal recrosis of the head range of hip movements. of femut. Shortening of less than 0.5" Patient was satisfied. Pair Union of the osteotomy. No pain. Slight limp but walk well. Fracture not united. Hild to moderate stiffness in the knee. Shortening of 0.5" to 1" condition was acceptable to the patient. Poor Pain in the hip. Non-union of both the fracture and estactomy Gross Lisp. Inability to walk with site or without aid. Severe stiffness in the hip or knee. Shortening of more than 1".

TABLE X

Goel et al (1980) Proforms for Assessment of Results
(After Chernley, 1972).

Points	and the same		rain	More- monte et bis	Walking
1	More		severe and epontamesus	0 - 300	Few yards or bed-ridden. Two sticks or crutches.
2	2 -	3•	Severe on attempting to walk, preventing all activity.	31 - 60°	Time and distance with or without atick.
•	1 -	2*	Tolerable permitting limited activity	61 -100°	Limited with a stick (less than 1 hour).Difficult without stick.
•	0.5 -	1.	Only after some activity. Disappears quickly with rest.	101 - 160°	Long distance with stick, limited without stick.
	0.0 -	0.5*	Slight or intermittent pain on start- ing to walk.	161 - 209°	No stick but limp present.
6	None		No pain	above 210°	Formal
Excell	ent :	More	then 20 points	- 16 pat	ients (24.2%)
Good		Do too	en 16-20 point	s - 32 pat	ients (48.5%)
Pals		Se tue	en 11-25 point	- 16 pat	ienta (27.3%)
Poor		Less	than 11 points		

Mehrotra et al (1982) evaluated the results of Me Murray's osteotomy as follows :

TABLE XI

signe (	and Symptoms	Index
Pain :	No pain	1
	Mild pain	2
	Moderate pain	3
	Severe pain	4
estate of	Sitting + Squatting	1
ielly life '	Active leg raising + Squatting not possible	
Sait :	Normal without stick	1
	Normal with 1 stick	2
	with 1 stick and lurch abnormalities	•
real	Less than 2.5 cm	
thortening '	2.5 to 4.2 am	3
	4.3 to 5.0 cm	3
	Moze than 5 cm	
cresente	Pull	
it kare :	Limitation at knee joint .	
	0 - 200	2
	21 - 45°	3
	46 - 90°	
core :	5 to 7	Good
	0 to 10	Setisfector (Acceptable
	More than 10	7002

\*\*\*\*

MATERIAL AND METHODS

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### MATERIAL AND METHODS

A study of feworal neck fractures treated by inter-trochanteric optodomy with internal fixation by 20° angulated Kessel plate has been conducted on the patients reporting to the Out Patient Department of Orthopsedic and Emergency ward under Orthopsedic Unit at M.L.B. Medical College, Jhansi. Suration of study was from July 1989 to July 1990.

All cases of displaced intro-capsular fracture nock femur below 60 years of age, fresh and old who agreed to this operation have been included in this study.

Detailed history regarding type and mode of injury, duration of injury, message, manipulations etc. was recorded. Thorough local and systemic examination was done especially regarding cardio-respiratory systems.

X-ray polvis with both hip joint in APS Lateral projection were done. Communition of fragments, changes in head, Absorption of mack, displacement and esteoporosis were examined in the X-rays. Routine pre-operative investigation of Blood, i.e. Mb%, TLC, DLC, ESR and Urine examination for albumin and sugar were done.

All those findings were recorded in working proforms.

### Classification of Intracapsular fracture :

I. <u>Pauvel's Classification</u> is based upon the angle between the fracture line and the inter-spinous line of the pelvis.

Grade I : 0 - 300

Grade II : 30 - 700

Grade III : 70 - 900 and ownerd.

Angle less than 30°, fracture is impacting and will unite soundly with any type of treatment. If the angle is between 30 to 70°, there is less impaction and some shearing strain, the fracture will not unite, unless this shearing force is overcome.

If the angle is between 70 to 90°, fracture line is so meanly vertical and the effect of shearing stress is so great that non-union may be enticipated, regardless of any method of internal fixation used.

Grade I is an oblique fracture whereas grade III is vertical.

II. <u>Linton's Classification</u>: Linton measured the angle of the fracture line in relation to the shaft of femures this furnished a more accurate measurement and it is not affected by the adduction or abduction of the limb.

### III. Garden's Classification :

Grade I - So called abduction or impacted injury in which the frecture of the inferior cortex is greenstick in nature, and a minimal degree of lateral rotation of the neck, creates a radiological illusion of impaction. The medial trabeculae of the neck lie in abduction as compared with those in the head which appear abducted.

Grade 11 - is a complete subcapital fracture without displacement. The inferior cortical buttress is broken but there is no tilting of the head.

Grade III - Complete subcapital fracture with pertial displacement. Lateral rotation of the distal fragment tilts the capital fragment into abduction and medial rotation as shown by the direction of the medial trabeculae in the famoral head.

Grade IV - is a subcapital fracture with full displacement. As the fragments become diverced from each other, the head returns to a more normal position in the scetabulum and the medial trabeculae of the femoral head lie in alignment with their fellow in the polvis.

### AIRS OF STUDY

 To internally fix the inter-trochenteric detectory for femeral mack fracture to allow displacement alongwith angulation at the osteotomy site.

- 2. To assess the results of inter-trochanteric dateotomy with "bent Kessel plate"in femoral mack fractures.
- 3. To study comparative effectiveness of bent Reseal's plate with the results, by previous workers, using straight plate for fixation of osteotomy site.

### Advantages of Displacement :

Line of weight bearing shifts medially, reducing weight bearing stress through the fracture. It provide an excellent arthroplasty even after non-union and avascular merosis.

### Disadvantages of Displacement :

- 1. Shortening of limb,
- 2. Verus positioning of head,
- 3. Abductor limp.

### Adventages of Angulation :

- 1. It converts vertical fracture line into horizontal fracture line. This converts the sheering force into compression force which helps in fracture union.
- Stability of hip is improved by making the abductors more taught by rotating the trochamter fragment, therefore abductor lurch is minimised.
- Apparent length of the limb is maintained due to abduction.

### Disadventeges of Angulation :

religion position, the lever arm between the trochenter and the head shortens. The pressure on the head increases because abductors attached on greater trochenter have to increase the pull to balance the downward thrust of body weight while walking. This increases pressure on femoral head, which may produce painful abductor lurch. The secondary strain on the lumber spine caused by this lateral lurching produce beckeche. Increased pressure on femoral head may predispose degeneration changes in joint.

### Advantages of internal fixation of osteotoey :

- The fragments are maintained in proper position.
- Pulmonary, wrologic and other medical complications, common in old age after immobilization is reduced, as plaster application is not required.

### Disadventages of plates :

Straight plates do not allow adduction of trochanteric fragments, thus interferring with the union of fracture whereas too much angulation of the plate may cause even distraction at fracture site due to excessive abduction of trochanteric fragments leading to mon-union.

Plates does not allow importion of femoral frequent into trochenteric frequent during the process of

healing. This may cause non-union at osteotomy site.

Complication because this can be avoided by impacting the fragments before plate application or by using compression device.

In this study estectomy was fixed by using a bent Kessel plate straight Kessel's plate was bent to 20°. Plate was not bent to more than 20° because more scute angle provides difficulty in introducing the plate into greater trochanter. Dangers of extreme valgus were also avoided. Plate was introduced by direct blow by mallet at the end of the plate.

Good grip was obtained over greater trochanter by serrated proximal end of Kessel's plate.

### Details of plate used :

Different length of Kessel's plates were used depending upon the age of the patients. Three hole-plate was used in children and four to five hole-plates were used in adults and elderly. The plates were bent just above the most proximal hole by help of plate benders to 20°.

### Pro-operative Treatment :

Each patient was kept on above knee skin traction with 3-6 kg weight until operation. This was done to relieve pain, numeries spasm and to minimise shortening.

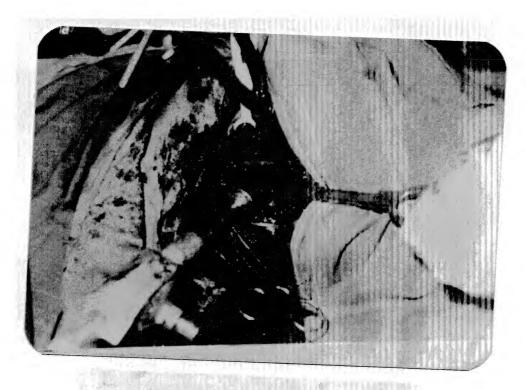
### Photographic presentation of technique used.



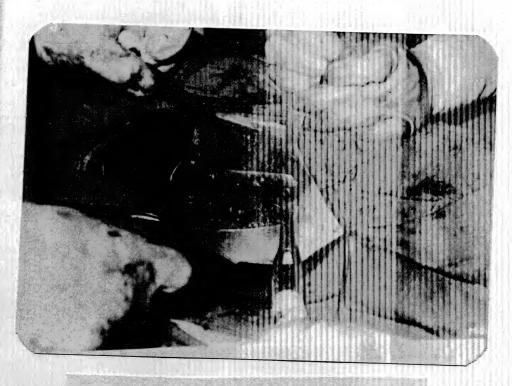
Lateral skin incision to expose proximal third of femur.



Proximal third of femur exposed.



First hole is being made by drill.



All screws have been introduced in their place.



Photographic presentation of X-ray of Intracapsular fracture neck femur.



Photograph of X-ray after Intertrochanteric osteotomy with bent Kessel's plate fixation.

### Operative steps :

In every case, closed reduction was tried by using one of the following techniques -

- a) whitman,
- b) Leadbatter,
- e) M. Flynn.

The reduction is confirmed by heel palm test. Then reduction is complete, the extended limb remains in neutral position, whereas unreduced limb springs tack into external rotation. No X-rays were taken for confirmation of reduction.

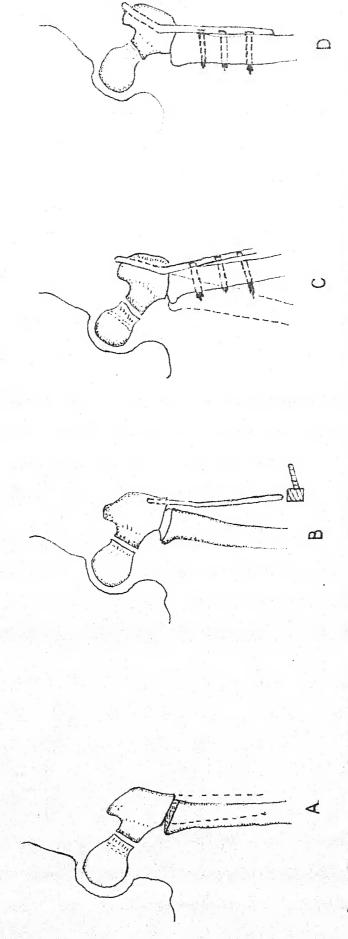
Amagesthesia used was either spinal or general.

Position was supine on fracture table. Incision given was standard lateral about 10 cm. extending from the tip of greater trochanter and carried distally. Some was exposed by cutting through Vastus lateralis muscle.

Lesser trochenter was palpated and an oblique estectory was done just proximal to the lesser trochanter and proximal portion of shaft was displaced medially.

place of the Kessel's plate was introduced through the cut surface of the greater trochanter and hammered in, upto the angle of the plate. Now the sheft was brought in contact with the plate and plate was fixed by means of acrews. Wound closed in layers and dressed. POP boot and derotation ber were applied.

## PLATE BENT KESSEL INTERTROCHANTERIC OSTEOTOMY WITH 20°



- Fracture reduced and an oblique osteotomy done just above the lesser trochanter and proximal portion of shaft displaced medially. 4
  - Blade of the plate introduced through the cut end of the trochanter and hammered up directly by mallet. B
- Shaft abducted till it is in contact with the plate and upper end of shaft impacted against the trochanter and fixed with plate by screws. ů
  - Fracture-shaft angle increased and head attain slight valgus position. å

### Post-operative care :

Just after patient was shifted to bed, a pillow was put below the knee to keep the hip and knee in slight flexion. Active movements and quadriceps exercises were started soon after effect of ensesthesia was over sitting in bed was encouraged from the next day and breathing exercise was explained.

stitches were removed after 2 weeks and exercises intensified.

After 8 weeks POP was removed and X-ray was done. Ance and ankle exercises were started on bed and patient discharged with advise to attend out patient department every 4 weeks.

X-ray was repeated every 4 weeks till the union of osteotomy site. Patient was allowed to move with bileteral amillary crutches efter 8 weeks without weight bearing and was allowed to sit on chair.

weight bearing and hip exercises were started only after estectomy had united and the patient was advised to walk with a stick in the opposite hand.

### Yellow-up :

All the patients were saked through postal correspondence to report at Orthopsedic O.F.D. for a follow-up examination at the interval of 8 weeks and

finally in September 1990. Those who did not come to the hospital were contacted personally at their residence. A detailed clinical examination in terms of function was carried out for which both subjective as well as objective criteria were undertaken.

### Subjective Criterie

- 1. Presence of pain at hip
- 2. Ability to walk
- 3. Ability to squat
- 4. Ability to sit cross-legged
- 5. Ability to sit on chair
- 6. Ability to climb stairs.

### Objective Criteria :

- 1. Ability to raise the limb in air
- 2. Tenderness at hip
- 3. Trandelenberg sign
- 4. Shortening of limb : Real and apparent
- 5. Deformities at hip
- 6. Deformities at knee
- 7. Range of movements at hip (passive)
- &. Range of movements at knee.

### Rediclogical Criteria :

- 1. Union at osteotomy site
- 2. Union at fracture site
- 3. Neck-sheft angle

- 4. Fracture-shaft angle (Linton's angle)
- 5. Changes in head of femur :
  - deformation
  - rerefaction / increased density.
- 6. Conditions of hip joint (joint space).

### Criterie for Evaluation of Results :

The criteria for evaluation of results of intertrochenteric osteotomy with bent kessel plate were derived
with additions and medifications in the criteria laid down
by Shephard (1954). In evolving these criteria, due
consideration was also made to those laid down by
mehrotra et al (1982), Mishra (1979), Chatterjee (1979)
and Chaturvedi and Gupta (1969).

		B.M.
1.	Pain :	
	No pain	0
	Mild	A 1 1
	Moderate	2
	Severe	3
2.	ectivity of delly life :	
	Sitting cross-legged	•
	sitting on chair	•
	squatting	•
	Inability to squat	

3. Call .	
Normal	0
with one stick	1
with two sticks	2
With axillary crutches	3
4. Real shortening :	
Less then 1.5 cm.	0
1.5 to 2.5 cm.	1
2.6 to 4.0 cm.	
More than 4.0 cm.	3
5. Fovements at Hip :	
Limitation by less than 15%	0
Limitation by 15 - 25%	1
Limitation by 26 - 50%	2
Limitation by 51 - 75%	3
Limitation more than 75%	
6. Movements at Abes :	
Full movements	0
Limitation of flexion :	
0 - 30°	1
31 - 45°	2
More than 45°	3

### 7. Radiological Criteria:

Union of fracture and osteotomy both

Union of esteotomy alone 1

Mon-union of fracture and osteotomy both

### Score :

wage is

Results are evaluated as excellent, good, fair and poor.

Excellent : 0 - 1 B.M.

Good : 2 - 8 B.M.

Fair : 9 - 12 B.M.

Poor : 13 - 21 B.M.

### PRUFURMA

### Case No. 7

M amo

: Sarju Bai

Age/Sex : 35 yrs./F

Body build a Medium

M.R.D.No.: 22237

Profession : Housewife

Address

& W/o Brahm Kishore.

Vill. Jatoli, Police Station-Sirsa Kalan,

Dist. Jaleum, U.F.

Date of injury : 26.11.89

Date of admission : 7.12.89

Meture of injury . Moderate

Date of operation :23.12.89

Time elepsed before operation : 2% days

Mistory of message/manipulation : Megative

Complete diagnosis

: Intracapsular fracture

Nock femur Left.

Pre-operative Examination

Shortening of Limb

: 0.5 cm.

Kage and ankle status

s Normal

General Exemination

: Satisfactory

I-ray

: Transcervical, Garden's Grade IV. non-communited, No rerefection, No absorption

of neck.

Pro-operative treatment

: A/X skin traction

Post-operative

X-Cay

: Fracture reduced, Linton's angle 45°, angle of estectomy 25°.

Period of follow-up

: 28 weeks.

Subjective : No pain in Hip, able to walk with one stick. can sit on chair, can squat, can sit cross-

legged, able to climb steirs.

Objective : Able to raise the limb in air, Tenderness at Hip absent, Trendlenberg sign negative.

Movements of Hip: Flexion 95°, Abduction 35°, Adduction 30°, Ext. and Internal rotation 20°.

Decrease in hip movement after operation : Less than 15%.

Movements at knee: Full flexion.

Shortening Real : 0.5 cm.

Apparent: 0.5 cm.

Radiological: Practure site united, estectomy site united, Neck shaft angle 135°.

Mip joint space maintained.

No avascular merosis.

Black Marks : 1

Recult : Excellent

Complication : MIL

\*\*\*

OBSERVATIONS

#### UBAKKYATIONS

Frement study was carried out during the period from July 1989 to July 1990 in the Department of Orthopsedics, F.L.B. Medical College, Jhansi.

The study was comprised of fifteen patients of intracapsular femoral mack fracture treated by intertrochanteric estectomy with bent (20°) Kessel plate.

### Age and sex :

Out of fifteen patients, twelve (80%) were male and three (20%) were female. Male-Female ratio was 4 : 1. The youngest was 14 years old and the eldest was 52 years (average 30.86 years).

TABLE ALL

Age (	rra) Itod	Nela 	Persla	Total	Percentage
11 -	20	4		4	26.66
21 -	30			5	33.33
31 -	40			2	13.33
11 -	50	31	1	3	20.00
51 -	60			1	6.66
rotal			2	15	

## Build and occupation :

Fourteen patients (93.33%) were thin to medium built. Only one was heavy built.

Build and occupation.

Build	**	*	Total	Ferden- tage	Occupation	worker	vor ke
This	•	*	7	46.66	) armer	*	•
					Housevi fe	3	
Pedium	5	2	7	46.66	Compounder	1	***
					Kentally retarded		
					student	2	**
Heavy	1	***	1	4.66	Merchant	3	*
					Blind	1	*
*****	12	3	15	lastili yikiti ootis seed-sinri viitin sidh saarasin		(73.33) (	26.64)

Eleven patients (73.33%) were sedentary workers.

## Sies of freature :

in eleven patients (7).33%) fracture occurred in

TABLE XIV

Side of frecture	nale	Yerale	Total	Fercentage
Left	9	2	11	73.33
Right	3	1	4	26.67
Total	erritarion de la company d La company de la	3	15	100.00

# Sature of Injury :

Eleven patients (73.33%) had sustained moderate injury. Three (20.00%) had severe and only one case (6.67%) had mild injury.

TABLE XV

Injury	Hale	Yemale	Total	Percentage
mild	•	1	1	6.67
Moderate	•	8	11	73.33
****	3			20.00
Total	12	3	15	100.00

# Time elapsed before operation :

Eight cases (53.33%) were operated after 2 to 4 weeks of injury. Three (20.00%) were operated after 6 - 8 weeks. Two (13.33%) were operated within 2 weeks while one each were operated after 4-6 weeks and 9 weeks (Case No. 3) respectively.

TABLE XVI

weeks .	Male	Female	Total	Percent age
within 2 weeks	2	•	2	19.33
2 - 4 weeks	6	2	8	53.33
- 6 weeks	1		1	6.66
- 6 weeks	2	1	3	20.00
) weeks	1	•	1	6.67
Potal	12	3	15	100.00

# Mistory of message and manipulations :

In 8 cases (53.33%) no message or manipulations was done, whereas vigorous message was done in 5 (33.33%). In 2 patients, there was history of gentle message.

TABLE AVII

Manipulations	Kale	Fe=ale	Total	Fercentage
Not done	6	2		53.33
Gentle	2	*	2	13.33
Vigorous	4	1	5	33.33
Total	12	3	15	

## Pre-operative knee and enkle status of patients :

Eleven patients had full range of flexion and extension at knee joints, while two patients (13.33%) had limitation of flexion upto 60° and other two at 90° respectively.

One patient had equinus deformity at ankle and was due to poliomyelitis (Case No. 3).

TABLE XVIII

Noversa		Male	Yesale	Total	Percentage
Knee -	Full flexion	8	3	11	73.33
	90° flexion	2	•	2	13.33
	60° flexion	2	alle-	2	13.33
Ankle -	Equinus deformity	1	**	1	6.67

## Pre-operative shortening (Real) :

Twelve (80%) patients had pre-operative real shortening of effected lower limb upto 2 cms and the rest three (20%) had shortening ranging between 2 to 3 cms.

TABLE XIX

Shortening	Kale	Perale	Total	Percentage
Upto 1.5 cms.		3	•	40.00
1.6 - 2.0 cme.	\$		•	40.00
2.1 - 3.0 css.	. (3	•	3	20.00
Potal		3	15	100.00

### Pre-operative Traction :

In fourteen patients (93.33%) pre-operative traction was applied by A.K. skin traction. In one patient (Case No. 9) no traction was applied and in one patient (Case No. 11), one and a half Hip spice was applied for two wonths till one month before operation. He was put on A.K. skin traction for 9 days before operation.

TABLE XX

Pre-operative traction	Kale	Perale	Total	Percentap4
No traction	1		1	6.66
A.K. skin traction	10	3	13	86.66
Spice followed by A.K. skin traction	1	•	1	6.66

TABLE XXI
Associated disease / injury.

Associated injury /	di sease	No.	of	G 5 5 6 5
Mentally retarded			1	
Pulsonary Emphysema			1	
Diabetes mellitus			1	
Blind			1	
Total			4	

## EFE-OPERALLYS A-FRY :

Type of fracture :- Ten patients (66.66%) had fracture of Garden's Grade IV and III and 60% of fractures were trens-cervical.

TABLE XXII

Type of	<i>Era</i> ctu		Maja 	Perale	Total	Percentage
Garden's	Grade	IA	4	2	6	40.00
	Grade	III	3	× 1	4	26.66
	Grade	II	5	*	5	33.33
Trans-ce	rvical		7	2	9	60.00
Subcapit	91		4	1	5	33.33
Low cerv	ical		1		1	6.66

## Communition of Freeture

In six (40.00%) patients, communition of fracture was present.

TABLE XXIII

Communition	Fale	Jenale	Total	Percentage
Present	5	1	6	40.00
Absent	7	2	9	60.00
Total	12	3	15	100.00

# Rerefection and absorption of neck :

1.

11500

Harefaction and absorption of neck were each present in two (13.33%) patients respectively.

TABLE XXIV

	Male	Yemale	Total	Percentage
				13.33
Rerefaction present	1		•	40.30
Absorption of meck	2	**	3	13.33

### Foot-operative A-ray :

## Reduction of fracture -

Reduction was tried in all cases. But it could be maintained in only eight (53.33%) cases post-operatively.

#### TABLE XXV

Reduction fracture	<b>⊕£</b> Starthjar-shellicetter terrestrumt subhicato rev-vjavnjaco	Kalo	rerale	Total	Percentage
Peduc tion	maintained	6	2		53.33
Reduction	lost	6	1	7	46.66

# Post-operative Linton's Angle :

aight (53.33%) cases had post-operative Linton's angle of less than  $30^\circ$ . The peak values were between  $45^\circ$  to  $55^\circ$ .

TABLE XXVI

	THE SOLUTION OF SOLUTION AND SOLUTIONS ASSESSMENT OF SOLUTIONS ASSESSMENT ASSESSMENT OF SOLUTIONS ASSESSMENT ASSESSMENT OF SOLUTIONS ASSESSMENT OF SOLUTIONS ASSESSMENT ASSESSM		inton's angle		Total	Percentage
0	<b>t</b> 29	100	1	6.66		
11	to	15°	4	26.66		
16	to	30°	3	20.00		
31	to	40°	4	26.66		
11	to	450	3	20.00		

# Angle of Detectomy :

Eight (53.33%) patients had estectomy angle of 20° or more.

TABLE XXVII

			0.008	Percent age
ess then	w°	3		20.00
100		4		26.46
ose then				53.33
ore than I				

### Period of follow-up :

Mine cases (60.0%) were followed-up for more than 6 months. Average follow-up was 32.06 weeks. Three patients were followed-up for about 12 months, and one was followed-up for only 16 weeks.

TABLE XXVIII

		od of ov-up	(weeks)	No.	o£	cases	Percentage
13	dia	17			1		6.66
18	***	22			4		26.66
23	***	27			1		6.66
28	*	32			3		20.00
33	*	42			2		13.33
63	***	51			4		26.66

# Post-operative shortening of limb :

sight (53.33%) patients had less than 1.5 cm shortening and majority fourteen patients (93.33%) had real shortening upto 2.5 cm and none had more than 4 cm.

TABLE XXIX

Real	s)	JOE .	teni	by	Ro.of	Percen- tage	Apparent shortening	No.of Cases	Percen-
Less	tì	an	1.5	CPP .	8	53.33	N11	10	64.66
1.6	CM	to	2.5	cm.	6	40.00	Lengthening upto 1 cm.	3	20.09
2.6	98	to	4.0	cm.	1	6.66	Shortening upto 1 cm.	2	13.33

66.66% patients had no apparent shortening or lengthening and 20% had even lengthening by 1 cm.

### Union of fractures :

In 40% cases fractures united and one case (Case No. 9) showed evidence of avascular necrosis.

TABLE XXX

	Martines realized to be witted to some over the party			
				er en
United	5	1	6	40.00
Non-union	7		•	60.00
Avascular mecrosis	1		1	6.66

# Union of Osteotomy :

Osteotomy site united in all cases (100%) and in eight (53.33%) patients within 8 weeks of operation.

TABLE XXXI

Duration of union	Pale	rorale	Total	Percentage
Within 8 weeks	7	1		53.33
9 - 12 weeks	3	2	5	33.33
13 - 16 weeks	2		2	13.33

## Trandlenberg sign :

In 3 patients test could not be performed due to pain in hip. In 3 cases Trendlenberg sign was positive.

TABLE XXXII

Test	No.of	Percent	Negative	Positive
Able to perform		80.00	•	3 (20.0%)
Not able to perform	•	20.00		

# Meck shaft angle :

Fracture united in six cases (40%). Fourteen (93.33%) cases had neck shaft angle more than  $120^{\circ}$ . One case (Case No. 6) had neck shaft angle  $145^{\circ}$ .

TABLE XXXIII

Hock	sheft	ang le		No.	of	Cases
	1200				1	
	1240				1	
	1300				1	
	1350				2	
	1450				1	

Hip joint space :- was maintained in all the cases.

# TABLE XXXIV

		80.0f 98898	Percentage
At His I			
a) Flexion	More than 90°	13	86.66
	Less than 90°	2	13.33
b) Abduction	30° or more	12	80.00
	Less than 30°	3	20.00
a) Abduction	20° or more	12	90.09
	Less than 20°	3	20.00
d) Extension	Upto meutral	10	66,66
	Plexion deformity	5	33.33
e) Lat. Hetation	Less than 25°	1	6.66
E) Med. Retation	Less than 200	4	26.66
Decrease in Hip	Less than 15%	•	26.66
ovements after operation -	Between 15-25%		53.33
yerecom -	Between 25-50%	2	13.33
	Between 51-75%	1	6.66
	Nore than 75%		
<b>Space</b> •			
) Flexion	Hormal	3	20.00
	Restriction by 30°	7	46.66
	Restriction by 31°-45°	3	20.00
	Restriction more than 45°	2	13.33
ecress in	Vachanged	10	66.66
thee perent	Degresse upto 15%	•	26.66
efter operation	Decrease more than 15%	1	6.66

Plexion at hip efter operation was more than 90° in 80.00% in 86.66% patients and abduction was more than 30° in 80.00% patients. Abduction was limited by 20° or less in 3 (20%) patients. Extension at hip was upto neutral in 10 (66.66%) patients and fixed flexion deformity was present in 33.33%. Lateral rotation at hip was less than 20° in 1 (5.66%) patient, whereas medial rotation was limited by 20° or more in 26.66%.

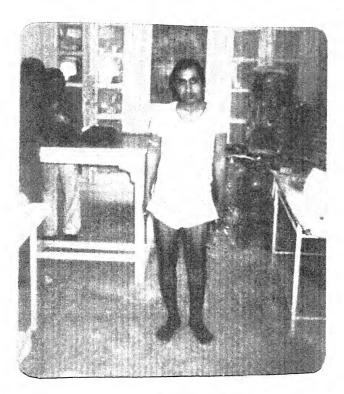
Thus less than 25% decreese in hip movements after operation was in 12 (80%) patients. Out of these, 4 patients (26.66%) had less than 15% limitation.

Twenty percent patients had flexion at knee almost normal. Ten (66.66%) patients had restriction at knee by  $30^\circ$  to  $45^\circ$ . Only two patient (13.33%) had restriction of more than  $45^\circ$  flexion.

hip after operation. There was no incidence of severe pain at hip, whereas 3 patients (20%) had moderate pain.

Mine patients (60%) could welk with the help of atleast one stick in opposite hand. Two patients (13.33%) had almost normal gait. Only 1 patient (Case No. 3) was bed-ridden.

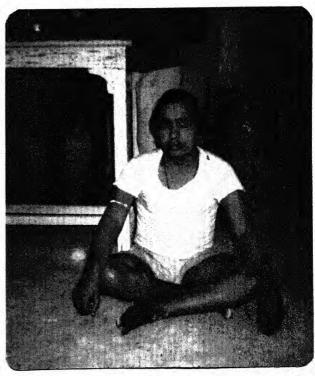
Case No. 1 after 45 weeks of follow-up.



Standing



Squatting



Sitting cross legged.

Case No. 8 after 36 weeks of follow-up.



Standing



Squatting



Sitting cross legged.

#### TABLE XXXV

Clinical study		No.of cases	Percent age
A. AUBJECTIVE			
1. Kais :	<b>811</b>	8	53.33
	Mild on prolonged walking	4	26.66
	Moderate	3	20.00
	Severe	***	•
2. <u>Gall</u> :	Hornel	2	13.33
	with 1 stick	9	60.00
	With 1 axillary crutch	***	*
	With 2 exillary crutches	4	26.66
J. Activities	of daily life :		
	Sitting on chair	15	100.00
	sitting cross-legged	9	60.00
	Squatting possible	9	60.00
	Inability to squat	6	40.00
	Ability to climb steirs	10	66.66
	Ability to raise the limb in air	11	73.33
- ONE-TAVE			
1. Tenderness	AT HER .		
	Absent	10	66.66
	MALA	2	13.33
	Moderate	3	20.00
2. Defermity	External rotation	•	26.66
	Genu Yelgus	1	6.66
	Fixed flexion deformity at hip		33.33

All patients (100%) were able to sit on chair.
But only nine (60%) could squat or sit cross-legged. Ten
(66.66%) patients were able to climb stairs, whereas 11
(73.33%) patients could lift their operated limb in air.

Tem (66.66%) had no tenderness at hip while Femalaing patients had mild to moderate tenderness at hip. One patient developed genu valgum after operation, whereas 4 (26.66%) patients had external rotation and 5 (33.33%) patients had fixed flexion deformities respectively at hip.

Results

			Result	Male	Penale	Total	Percentage
0	**	3	Escellent	1	1	2	13.33
2	400	8	Good	•	1	10	66.66
•		12	Pair	1		3	13.33
13		above	Poer	1		1	6.66

In this study, excellent to good results were obtained in 12 (80%) cases. Only in 1 patient (6.66%) poor result was obtained.

#### Excellent (Black marks 0 - 1) :

(13.33%), one patient was male and other female. Both had no pain at hip, could squat and sit cross-legged. One of them (Case No. 8) would walk without any support and other (Case No. 7) could walk with a stick in opposite hand. Shortening (real) in both cases was 0.5 cm. Movements at hip were limited by less than 15% and at knee were almost full. In both cases fracture and osteotomy sites had united.

#### Good (Black marks 2 - 8) :

patients were male and one female. Eight patients had pain at hip. Two patients had mild pain on prolonged walking. All those patients could sit on chair. However, only seven could squat and sit cross-legged. Remaining could not do so because of stiffness at knee joint and full flexion was not possible. All those patients could walk with the help of one stick except one patient who could walk with the help of grutches. In all those patients shortening of limb was upto 2 cm. and hip movements were only limited by 25%. Cotectory site was united in all cases, but fracture site united in five of those cases.

#### Pair (Black marks 9 - 12) :

Two patients (13.33%), one male and other female has fair results. They had moderate pain at hip, could sit on chair, but could not squat and sit cross-legged. One case (Case No. 3) was not able to walk, as he was mentally retarded and was having equinus defermity of foot. Other patient (Case No. 12) could walk with bilateral oxiliary crutches. Real shortening was less than 2 cm. Hip movements limited by 26 - 50%. Knee movements were restricted to 40° flexion in case No. 3. Osteotomy united in both these cases but fracture not united.

### Poor (Black marks 13 omwards) :

One patient (Case No. 6) showed poor result.

Moderate pain at hip was present. He was able to walk

with crutches and could sit in chair, but was not able to

squat or sit cross-legged and climb stairs. He was not able

to raise the limb in air. Trendlemberg sign was positive.

povements at hip were restricted more than 25% and flexion at knee was 80°. Real shortening was 3 cm. Optobory site had united, but fracture was not united. He was suffering from Pulmonary mephysema and Anapaia.

TABLE XXVII
Post-operative Complications.

Complications	No.ef	Percentage
Infection	1	6.66
Moderate pain at hip	3	20.00
knee stiffness	5	33.33
Fixed fluxion deformity at hip	5	33.33
Real shortening were than 2.5 cm.	1	6.66
Cenu Valgum	1	6.66
Post-operative death	MAI	•

One patient (Case No. 3) developed post-operative discharging sinus. He was readmitted and plate was removed after 7 months of previous operation. He was given adequate entiblotics after pus culture. At the time of completion of study, infection has completely cured, 33.33% patients developed deformity at hip and knee joints. Post-operative pain was seen in 3 patients (20%). No post-operative death opensed.

\*\*\*\*

DISCUSSION

#### **DISCUSSION**

The femoral neck fracture, still deserves the title of 'unsolved fracture', because even today it is a difficult problem to tackle. Despite much better knowledge of this fracture and marked improvement in the methods of its treatment the failure rate still remains high. Mc Mugray's osteotomy was proposed as a salvage procedure for non-union of femoral mack fracture in 1936 and used as a method of treating even fresh sub-capital fracture (Ether, 1936; Mc Mugray, 1938; Dawkins, 1941; Blownt, 1943; King, 1950).

Slowet in 1943 advised internal fixetion of fracture and osteotomy. It was done to avoid the difficulty of maintaining the fragments in a hip spice. King in 1950 advocated a combination of mailing of fracture and fixation of osteotomy with plate in fresh femoral mack fractures.

Kirkup (1963) and Poppworth (1963) with improved femalts.

In India, He Huzzay's octootomy has been used even in fresh femoral mock fracture at many centres with encouraging results (Vyeghees-Hañadu, 1956; Doraiswami, 1964; Shanmali, 1966; Dholakia, 1968; Gupta, 1969; Kishra, 1979; Goel, 1980; Mehrotra, 1982).

It has been stressed by many surgeons that immebilization of fragments after estectomy by POP hip spice

is batter method, because it stabilizes the fracture and osteotomy both. For these reasons, they give preference to this method rather than fixing osteotomy alone with an osteotomy plate like that of wain wright or Kessel. According to them chances of union at fracture site are increased by plaster immobilization (Mc Murray, 1936; Cheturvedi and Gupta, 1969; Rallan and Szivastava, 1976; Mishra, 1979 and Goel et al. 1986).

by elderly patients, in which prolonged immobilization in hip spice could be dangerous, because of cardio-pulmonary and urologic complications due to recumbency (Chatterjee, 1979). So there should be some device by which patient may be made ambulatory as early as possible without materially interfering with the results. Internal fixation of fracture and estectony both by a nail plate assembly may be useful, but introduction of nail is again a problem as it needs efficient X-ray facility in operation theatre and accurate reduction of fracture.

In India, most of the peripheral hospitals do not have per-operative X-ray facility and at the same time, is is often difficult to schieve a satisfectory anatomical reduction especially in older fractures or due to communition of the neck. Hail too has its own disadvantages such as s

(i) nail may protude into the joint resulting into ankylosis or secondary osteo-arthritis.

(ii) The nail may lead to increased chances of evaccular mecrosis or even non-union of the fracture, because healing of the fracture of the femoral neck occurs through the endosteal callus and vascular supply of femoral head may be hampered by introduction of nail.

Internal fixation of the osteotomy alone has been treated by straight osteotomy plate like Kessel's, Wain wright or Chatterjee (Chaturvedi and Gupta, 1969; Rallan and Srivastava, 1976; Gool et al, 1980; Mehrotra et al, 1982) but with lower percentage of fracture union in comparison to cases those immobilized with POP hip-spica. It may be, because straight plate immobilizes osteotomy alone without allowing adduction of the trochanteric fragment which was essential for the union of fracture (Chaturvedi and Gupta, 1969; Wardle, 1955). For achieving adduction bent esteotomy plates like reversed Blount or memfeld mail were used, which were surprisingly not widely accepted unit, Chatterjee described his own bent compression esteotomy plate in 1979.

Chatterjee (1979) described a new technique of Mc Murray's osteotomy fixed with 30° angulated compression plate, by which angulation as well as displacement both were schieved with premising functional results. His procedure was simple to perform and problems of non-union, evascular mecrosis and come were minimised. Functional results

were least affected even if the fracture failed to unite and shortening often described as a constant feature often cuffer me Murray's estectory was minimised to great extent.

In the present study, 15 patients of femoral nack fractures were treated by inter-trochanteric estectory fixed with 20° angulated Ressel's plate. This angle was less than that of Chatterjee's 30° angulated compression plate. It was done to avoid the difficulty in introduction and fixation of plate and to avoid extreme valgus positioning of the femoral head, which may result into secondary genu valgum that foot and secondary estec-arthresis of the hip.

Male-female ratio was 4 : 1. The youngest was 14 years old and the eldest was 52 years. The average age was 30.86 years. The age and sex of the patients of this present study is consisted with that of other Indian studies of Misra (1979), Mehrotra (1982), Goel et al (1980) and Rallan & Srivastava (1976), but is in variance with reports published in Mestern countries (Mc Murray, 1938; Seigh, 1941; Cleveland Bailey, 1950; Mc Neur, 1953) where the average age of the patients is higher and females out-numbered males. In our sub-continent, males especially below 60 years of age are responsible for earning livelihood for their families. In lower socio-economic group, this usually involves hard manual labour, thus increasing the vulnerability of male population.

In our country, patients usually attend hospital late. \$3.33% fractures were more than 15 days old, one patient was even more than 2 months old (3).33% had been initially treated with repeated vigorous manipulations and massage). This was again similar with the findings of other indian studies.

26.66% patients had stiffness of knee pre-operatively.

Out of which two patients had only 60° range of flexion.

This was chiefly due to massage manipulation and disuse,

prior to hospitalisation. All these patients had attended

hospital after one month of injury.

All the patients had shortening of affected limb. 80% patients had real shortening of upto 2 cm and 20% between 2 to 3 cm. This was due to over-riding of fragments and/or absorption of neck as the patients were brought to haspital late.

In 96.66% cases, above knee skin traction was applied. In one petient (Case No. 1), no traction was applied. Traction was to minimise shortening and relieve pain and muccular space.

Reduction was tried in all the cases but could be maintained post-operatively in only \$3.33% cases. In remaining cases, reduction was either not achieved or was displaced during operation due to hammering of plate to insert it in greater trochanter or during conducting

fracture union, therefore gentle hammaring should be done and Giglisew could be used in place of osteotoma while doing osteotomy.

The importance of fracture shaft angle (Linton's angle) was recognised by Pauvel (1935), Eyro-Brook and Fridie (1941), Perlinton (1944), De Falma (1950), Mc Neur (1953), Kirkup (1963), Popuerth (1963). Mc Neur abserved that subsapital fracture of the femoral neck with low fracture-shaft angle usually fail to unite even after standard 5.P. mailing in comparison to those where fracture line is more herisontal, i.e. higher fracture-shaft angle. He has recommended a wedge estectomy with mail plate and suggest that amount of wedge should be determined according to the fracture-shaft angle.

In this study, in 5 (40%) fractures united. All of those had poet-operative fracture-shaft emple impressed to above 40°. One (Case No. 1) had post-operative Linton angle 60°. Fracture united probably due to conversion of shearing stress into compression force at the fracture site.

He Hour suggested certain criteria for an ideal osteotomy.

- 1. It should be easy and repidly performed.
- To be stable and should not require immobilization in plaster.

- 3. It should give an adequate and accurate degree of abduction of the lower fragment.
- 4. It should not restrict any further reconstruction, if required, i.e. prosthetic replacement of head in cases of awascular mecrosis if develops.

An inter-trochenteric esteotomy fixed with plate, is easier to perform and to obtain stability, a wedge osteotomy with base laterally should be ideal. Mc Neur obtained bony union of fracture and esteotomy both in 89% cases with good functional results without measurable alteration is apparent length of the limb. Fracture-shaft angle was increased to 55° or more.

#### Level of Ostsotomy :

Mc Murray (1936), Dickson (1947), Green (1967),
Mishra (1979), Mehrotra (1982), Chaturvedi and Supta (1969)
recommended inter-trochenteric estectomy just above the
leaser trochenter with medial displacement of the distal
fragment, thus shifting the line of weight bearing more
medially to relieve shearing at fracture site. Mishra
has postulated that it prevents upwards displacement of
greater trochenter thus decreasing shortening and when
displaced medially, lies below capital segment of fracture
site, thus it acts as home graft and also increases the
vescularity of fracture. Mc Murray (1936) observed that

cateotomy performed its function by changing the line of weight bearing so that the weight could be borne in a direct line with the femoral head even if there was non-union at fracture site thus not interfering with the functional results of hip.

Blount (1943) emphasized that the best end results are obtained by an osteotomy at the level of lesser trochanter with angulation of the proximal fragment and some medial displacement of the distal fragment.

In this series osteotomy was done just above the lesser trochenter and the medial displacement was just more than enough for the introduction of the plate.

#### Post-operative care :

quadriceps exercises started as seen as post-operative anaesthetic effect and pain subsided i.e. after 2nd or 3rd post-operative day. POF de-rotational boot and ber was applied in all the cases and retained for 8 weeks to check rotation of the fracture site. Knee mobilization exercises started in most cases from 5th day and partial weight bearing allowed after 8 weeks with help of bilateral axillary crutches as the X-ray by that time showed esteetony union.

Twelve (80%) patients had practically painless hip as compared to 76.2%, 86.5% and 66.5% in the series of

Mehrotra et al (1982), Gupta and Chaturwedi (1973), Mishra (1979) respectively. Only 73.33% cases were able to raise the limb in air actively whereas in the series of Mehrotra (1982) all patients could raise the limb in air. In the present study who could not raise their legs were found to be due to muscular weakness.

All patients were able to sit on chair but only 60% cases could squat, sit cross-legged and climb stairs. Squatting and sitting cross-legged needs full flexion over hip and knee joints alongwith full external rotation and 90° abduction at hip, while sitting on chair needs only 90° flexion at hip. In our series flexion at hip was 90° or more in 86.66% cases. In two cases (case No. 3 and 13) flexion at hip was less than 90°. It was due to non-co-operation of these patients in performing physiotherapy advised to them, as one of them was mentally reterded and other blind respectively. Restriction by more than 45° at knee was present in one patient (Case No. 3) due to above mentioned cause. Method of immebilisation had no effect on squatting ability (Mehrotra et al. 1982).

In the present study two patients (13.33%) could welk without any support, 60% patients could walk with one stick in opposite hand, while 26.66% could walk only by the help of 2 exillery crutches. This was allowed to them to avoid full weight bearing at fracture site as the follow-up period was short. In these cases cateotomy had

united but fracture was not united. Average follow-up period was 32.05 weeks, 66.66% cases had no tenderness, while 46.66% cases had mild to moderate tenderness at hip. Tenderness was present at base of femoral triangle in these cases, where fracture was not united.

#### Deformity at Hip :

Four cases (26.66%) has mild externel rotation deformity, five cases (33.31%) had mild fixed flexion deformity and one (6.66%) had Genu valgum deformity. External rotation and fixed flexion deformities could be due to fixation of the osteotomy site in slight external rotation and flexion. Genu valgum in Case No. 12 was due to increase in neck-sheft angle cause by introduction of Kessel's plate more medial in greater trochanter.

Trendlenberg sign : 80% patients were able to bear weight on the effected limb without support and Trendlenberg sign was positive in 3 patients (20%). In one patient (Case No. 12) it was due to genu valgum and in other two was due to weakness of abductors of hip as considerable time had elapsed after injury when operation was conducted. It was not due to defect of estectomy.

Thus we can say that inter-trochanteric estectory loads to definite increase in the stability of hip without interfering the hip movements when conducted carefully.

- 1. It increases leverage.
- 2. Improved efficiency of the gluteus when they are taught.
- Contact of the angulated upper fragment against pelvic wall (Me Murray, 1983; Schanz, 1928).

patients (53.33%) cases union occurred within 8 weeks after operation. Upper part of the distal fragment was impacted with the cut end of greater trochenter before fixing it with the plate so as to provide better bony contact at osteotomy as also suggested by King (1950). In 13.33% cases osteotomy took more than 13 weeks to unite as the open wedge was wider.

mobilization of joints maintains a good range of movements at hip compatible with functions of our daily life like squatting, sitting cross-legged. The unitation of extremo adduction at hip is acceptable.

In this series abduction less than  $30^{\circ}$  and adduction less than  $20^{\circ}$  was present in only 20% cases.

The limitation of hip movement was 25% or less in 80% cases of this series, while in only one patient (Case No. 3) limitation was 60%, due to non-cooperation in physiotherapy advised. In others limitation more than 25%

was due to pre-operative massage, manipulations or coming late to the hospital which leads to capsular contracture.

down advocates of the reconstruction type of operation have emphasized the fact that their procedure is preferable because it does not require any form of external fixation such as a Plaster of Paris spica, while the osteotomy necessitates bed confinement and is particularly conductive to joint stiffness. Reich (1941) was of the opinion that the plaster spice should be supplied with both the hip and knee completely relaxed and in slight flexion, and the abduction is achieved by forcing the distal esteptomy fregment inward rather than by abduction of the leg. As a consequence, the POP hip spice is applied with no undue strain on the ligaments of the kace. Reich further said that, unless there is an active knee joint disease, there need be no fear of joint stiffness, where one is apprehensive of any knee joint stiffness because of osteo-arthritis or any other cause a plaster of paris spice way be applied with steel hinges incorporated in the plaster cast at the knee joints thus permitting active and passive knee motion.

26.66% cases had knee stiffness where flexion at knee was possible only upto 90° or less. This was constant in cases who attended hospital late and took treatment in the form of massage, manipulations etc. Osteotomy fixed with bent Ressel plate had no effect on knee stiffness.

## Chartening of Lieb:

Shortening of the limb efter Mc Murray's osteotomy is a constant feature.

leg length is secrificed and consequently shortening is increased following a high oblique osteotomy. Meich (1941) was not convinced with this opinion and observed that, when the osteotomy is performed at the desired level, the un-united head which is in consevera, is frequently rotated upward by pressure from the lesser trochanter and is actually replaced in its enstemical position. When the osteotomy is performed at inter-trochanteric level, the obtusion of the angle formed by the meck and shaft is increased (increase in neck shaft engle), consequently increasing the limb length.

Blount (1943). Chaturvedi and Supta (1969) and Chatterjee (1979) observed that abduction of the limb after octoology minimises shortening.

in the present series, 93.33% cases had postoperative shortening of less than 2.5 cm and none had more
than 4 cm. 66.66% patients had even less than 1.5 cm
shortening. All those cases (40%) where fracture united
had nock shaft angle more than 120°, i.e. head was in slight
values position.

Thus the decrease in the shortening may be due to :

1. Increased muck shaft angle (Reich, 1941).

- 2. Level of osteotomy just above the lesser trochanter which does not allow the trochanter to slide upward to produce shortening (Mishra, 1979).
- 3. Angulation at ostootomy site.

The Valgus position of limb after osteotomy produce apparent lengthening thus compensate for real shortening. The finding of increased shortening in patients who attended hospital late was similar to that of other series (Mishra, 1979; Goal, 1980).

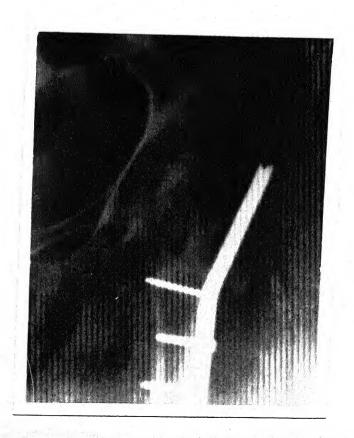
Functional results of the present series has been compared favourably with those of Chatterjee (1979) and Goel et al (1980) in the following table.

## Comparison of Functional Results.

-	Various methods	No.of	Tune Light Land Li								
Market Services	of impobilisation	cases	Lient	Good	Yair	5000					
1.	Osteotomy with straight plate (Goel et al. 1960)	30	(21.0%)	18 (47 -4 x)	(31.57%)	•					
2.	Ostootomy with POP hip spice (Goel et al. 1980)	20	(28.57%)	(\$0.0%)	(21.42%)	•					
3.	Osteotomy with heat Chetterjee plate (Chatterjee, 1979)	94	(21.2%)	59 (62.76%)	23 (24.46%)	10 (10.63×					
۱.	Osteotomy with best Accest plate (Mohindra, 1986)	13	2 (19.66%)	(66.7x)	(16.66%)	•					
B.,	Octobery with best Reseal plate	15	(23,32%)	(66.66%)	(13.33%)	(6.6620					



Photographic presentation of pre-operative X-ray of Case No.12.



Photograph of X-ray of same patient after 26 weeks showing union of

# Comparison of Radiological Pesults

malantani.	Nethod of Immobilis	atlos	No.ot cases	Fracture union(%)	union (X
A.	Fixation of frectur osteotomy both by Hail Plate:	e and			
	King	(1950)	50	71.0	100
	Kirkup	(1963)	41	61.0	100
	Osteotomy with POP spice :	Kip			
	Goel et al	(1980)	28	1.4	100
	Mehrotra et al	(1982)	30	70.0	100
*	Chaturvedi and Gupta	(1969)	50	50.9	100
	Michra	(1979)	32	84.4	100
	Fixation of Osteotowith straight plate				
	Cheturvedi and Gupta	(1969)	5	•	100
	Mishra	(1979)	3	33.3	100
	Goel et al	(1980)	38	\$2.6	100
	Mehrotra et al	(1982)	39	23.0	100
٠.	Pixetion of Osteotor with amoulated plate	ry			
	Chatterjee	(1979)	100	79.0	100
	Y. Mohindra	(1986)	12	58.4	100
	Present series	(1990)	15	40.0	100

If the radiological results of the present series are compared with other series of inter-trochanteric osteotomy in fracture neck femur using various methods of immobilization, it will be found that the union of osteotomy is constant irrespective of the method of fixation.

fixation of fracture and estectory both either by neil-plate or plaster hip spice, whereas it is quite low in series using fixation of estectory alone by straight plate. This drawback has probably been removed to some extent by using a bent estectory plate by increasing the fracture-shaft angle. However, in the present series the percentage of fracture union is slightly lower as compared to work on fixation of estectory with angulated plate by previous workers (Chetterjee, 1979; Mohindra, 1986).

Avascular necrosis has occurred in one case

(Case No. 9) of present series. However, Chatterjee (1979)

also using best estectomy plate has shown 15% avascular

mecrosis.

Procedure		Xo.of cases	Percentage of avascular pecrosis
. Pixation of fracture and			
osteotomy both by nail pla	re :		
King (1956)		50	4.0
Kirkup (1963)		41	22.0
POP hip spice and/or strai			
Chaturvedi and Gupta	(1969)	55	16.4
Chaturvedi and Gupta	(1973)	38	18.42
Michra	(1979)	51	3.0
Goel et al	(1980)	66	10.2
. Osteotory with bent plate			
Chatterjee	(1979)	100	15.0
Mohindre et al	(1986)	12	•
Procent series	(1990)	15	6.66

Thus, it is to be noted that the percentage of avascular necrosis does not changes significantly by using different methods of fixation.

Comparison of Results of Mc Murray's Osteotory shown in various series

adddan palacenia (fillio), (the hit routh a mericine, compressed and files and a social fillion and also comme also dan colors and		Be.of	The state of the s								
Authors	Yest	CAROS	Excellent	Cood	Fair	Poot					
Mc Murray	19 38	33	**	(100%)	sie	*					
Reich	1941	26	•	22 (84.61%)	*	(15.30%					
King	1950	50	•	(190%)	•	•					
etrie 1950 25		•	25 (100%)	*	•						
Chaturvedi and Gupta	1969	55	9 (16.36%)	33 (60.0%)	10 (18.18%)	(5.45%)					
Vupts and Chaturvedi	1973	30	(28.95%)	10 (47.37%)	(10.53×)	5 (13.15x					
Rellen and Srivestave	1976	50	(16.0%)	(38.0%)	(30.0%)	(14.0x)					
Kiehra	1979	51		66.	6%	33.3%					
Coel et al	1980	66	14 (24.24%)	32 (48.48%)	(27.27 x)	•					
Nohindra et al	1966	13	(16.66%)	(66.7x)	(16.66%)	9					
Fresent series	1990	15	(13.33%)	9 (66.66%)	(13.33%)	(6.66%)					

The results of present series are consistent with those of previous workers where osteotomy was fixed with angulated plates.

Comparison of Rediplogical Status of follow-up in various series after Mc Murrey's Osteotomy.

Authors	Year	No.of	Union of estectomy	Union at fracture (%)	Avasculat macrosis (%)
Me Murray (according to Putti)	1947	22	100	100	***
King	1950	50	100	71	4
Kirkup	1963	41	100	61	22
Cheturvedi and Gupta	1969	55	190	50.9	16.4
Cupta and Chaturvedi	1973	38	100	60.9	18.42
Rallan and Srivastava	1976	50	98	42.0	**
Hishra	1979	51	100	73.8	3
Chatterjee	1979	106	100	79.0	15
Goel et al	1980	66	100	50.6	10.2
Mohrotre et al	1982	69	100	46.5	•
Mohindre et #1	1996	12	100	50.4	•
Present series	1990	15	100	40.0	6.66

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CONCLUSION

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#### CONCLUSION

After evaluating the results in the present series, it is evident that, inter-trochenteric estectomy with bent Kessel plate fixation in femeral neck fracture may give excellent results if reduction of fracture is maintained during operation and post-operative physiotherapy course is followed properly.

The following conclusions were drawn :-

- Inter-trochanteric osteotomy with best Ressel plate fixation is suitable for introcepsular fracture neck femur preferably in cases below 60 years age.
- It can be recommended for the cases of both, non-union and fresh intracapsular femoral mack fractures.
- 3. Operation should be conducted over fracture table to maintain the reduction at fracture table.
- 4. During introduction of plate into greater trochanter, gentle bemmering should be done and greater trochanter pushed down by bone lever, as there is great risk of lesing reduction.
- 5. Post-operative POP boot and de-rotation bar was found effective because early knee mobilisation exercises could be started.

- 6. Patient should be allowed partial weight hearing soon after union of osteotomy, as shearing force after operation is converted to compression force and thus aid in union.
- Union of fracture site depend upon retaining of reduction at fracture site.
- 8. This procedure is simple to perform and do not require special instruments or per-operative x-ray facilities.
- 9. There is less incidence of evascular necrosis and joint stiffness in this procedure.
- 10. Advantage of this procedure is that who ther fracture unites or not, patients have good functional results.

This procedure is best suitable for patients of our country, as it allows good movement over hip and knee end thus patient can carry out his daily work like - defectation, taking meals and worship.

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SUMMARY

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## SUMMARY

The fracture of feweral meck is a common injury of old age, of either sex. Years ago, this fracture was often a terminal event, because prolonged recumbency and immobility used to cause cardiac, pulmonary or renal complications in already trail and fragile elderly.

Femoral nack fractures has been treated by various methods, but so far none of them is without its drawbacks. Thus, it still deserves for the name of "unsolved fracture".

Mc Murray (1936) popularised inter-trochamteric octootomy for mon-union of Semoral neck as a salvage procedure. Mc Murray (1938), Blount (1943), King (1950) and many others used it even in fresh fractures with good results.

Internal fixation of the osteotomy has been advocated to obviate the need of plaster for which a number of osteotomy plates were tried, but all of them were straight.

Chatterjee (1957), and Y. Mohindra et al (1986) have used best estectomy plate with improved results,

because straight plates were not able to change the fracture shaft angle and often produce comevers.

The present study was conducted on the patients of Orthopsedic department of M.L.B. Medical College, Jhansi, from July 1989 to July 1980. Fifteen patients underwent for inter-trochanteric osteotomy fixed with the best kessel's plate.

Different types of femoral neck fracture, except those having avascular necrosis or absorption neck and patients below 60 years were taken for the present study. In the present series, 12 patients were male and 3 females. Average age was 30.86 years. Thirteen patients (86.66%) were operated after 2 weeks of injury. Mistory of manipulations or vigorous massage was present in 33.33% cases.

All patients except one treated were treated by above knee skin trection till the date of operation. Reduction was tried in every case. Standard lateral incision for proximal femur was used and Mc Murray's osteotomy was performed upper end of pre-bent (20°) Kessel plate was introduced in greater trochanter upto the angle and shaft abducted to bring in contect with the plate, which was then fixed by the help of screws. POP boot and de-rotational bar was applied to all patients. Sitting on

bed was allowed from 2nd day of operation. Partial weight bearing was allowed after union of osteotomy.

Fre and post-operative X-rays of polvis with both hips were taken in all the cases.

After outlining a criteria for the type of results, the results were noted after July 1990 and were found to be 13.33% excellent, 66.66% good, 13.33% fair and 6.66% poor. It was evident from the results in the present series that in cases where fracture united and patients who carried out post-operative physiotherapy advised properly the results were better.

After evaluating the results in the present series, it is evident that, inter-trochemteric setsetomy with bent Kessel plate fixetion in femoral neck fracture may give excellent results if reduction of fracture is maintained during operation and post-operative physiotherapy course is followed properly.

The following conclusions were drawn :-

- Inter-trochenteric osteotomy with best Kessel plate fixation is suitable for introcapsular fracture seck femur preferably in cases below 60 yrs. age.
- It can be recommended for the cases of both, non-union and fresh intracepsular femoral neck fractures.

- 3. Operation should be conducted over fracture table to maintain the reduction at fracture table.
- 4. During introduction of plate into greater trachenter, gentle hammering should be done and greater trachenter pushed down by bone lever, as there is great risk of losing reduction.
- S. Post-operative POF boot and de-rotation bar was found effective because early knee mobilisation exercises could be started.
- 6. Patient should be allowed partial weight bearing soon after union of osteotomy, as shearing force after operation is converted to compression force and thus aid in union.
- 7. Union of fracture site depend upon retaining of reduction at fracture site.
- 8. This procedure is simple to perform and do not require special instruments or per-operative X-ray facilities.
- 9. There is less incidence of avecular necrosis and joint stiffness in this procedure.
- 10. Advantage of this procedure is that whether fracture unites or not, patients have good functional results.
- 21. This procedure is heat suitable for patients of our country, as it allows good novement over hip and knee and thus patient can carry out his daily work like defaccation, taking meals and worship.

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